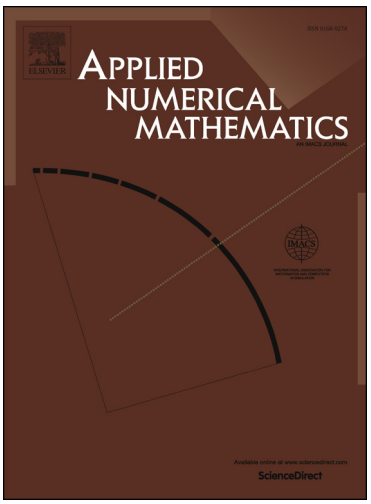
Accepted Manuscript



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PII: S0168-9274(18)30156-9
DOI: https://doi.org/10.1016/j.apnum.2018.07.008
Reference: APNUM 3399

To appear in: *Applied Numerical Mathematics*

Received date: 3 March 2018
Revised date: 13 July 2018
Accepted date: 14 July 2018

Please cite this article in press as: R. Mollapourasl et al., Localized kernel-based approximation for pricing financial options under regime switching jump diffusion model, *Appl. Numer. Math.* (2018), https://doi.org/10.1016/j.apnum.2018.07.008

Localized kernel-based approximation for pricing financial options under regime switching jump diffusion model

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Abstract

In this paper, we consider European and American option pricing problems under regime switching jump diffusion models which are formulated as a system of partial integro-differential equations (PIDEs) with fixed and free boundaries. For free boundary problem arising in pricing American option, we use operator splitting method to deal with early exercise feature of American option. For developing a numerical technique we employ localized radial basis function generated finite difference (RBF-FD) approximation to overcome the ill-conditioning and high density issues of discretized matrices. The proposed method leads to linear systems with tridiagonal and diagonal dominant matrices. Also, in this paper the convergence and consistency of the proposed method are discussed. Numerical examples presented in the last section illustrate the robustness and practical performance of the proposed algorithm for pricing European and American options.

Keywords: Radial basis functions, Finite difference, Option pricing, Regime-switching models, Jump diffusion, Operator splitting method, Convergence

1 Introduction

Unlike the standard Black-Scholes model [9] which assumes that the underlying assets follow a geometric Brownian motion with constant mean return and volatility, the rationale behind the regime switching framework is that the market may switch from time to time among different regimes. In short-term political or economic uncertainty, this property of regime switching model help us to account for certain periodic or cyclic patterns. In many practical researches such as [6] regime switching model has been used widely. Some of regime switching applications are in insurance [28], electricity markets [27, 48], natural gas [13, 1], valuation of stock loans [53], and interest rate dynamics [32].

Jumps are regularly observed in the discrete movement of stock price and these jumps can not be captured by the log normal distribution characteristic of the stock price in the Black Scholes model. Therefore an alternative model is necessary to overcome these issues. To resolve these issues several models have been proposed in the literature. Among these, the jump diffusion model introduced by Merton [39] and Kou [34] is one of the most used model. These models have finite jump activity, unlike the more